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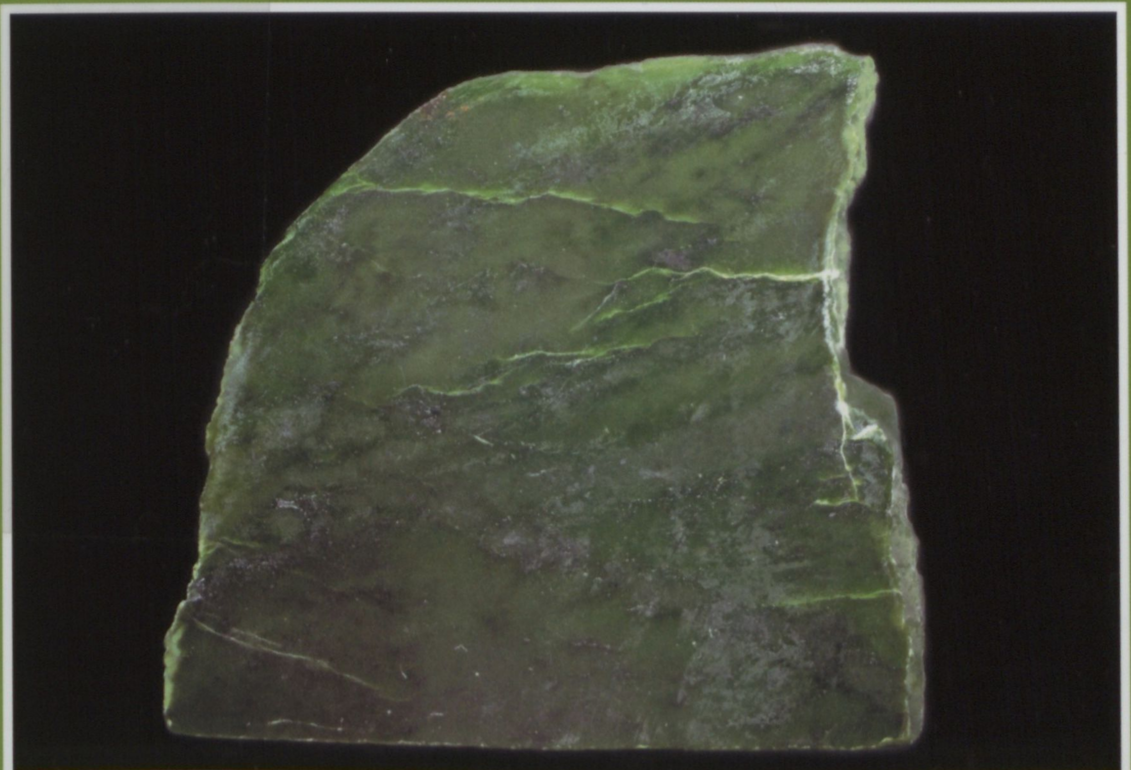

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On the cover: Nephrite from Jordanów Śląski, Poland. Hand specimen, 15 cm in height.
Photo: Eligiusz Szełęg.

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ACTA Mineralogica Petrographica

Mineralogy of Lower Silesia, Poland

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1. Introduction

Lower Silesia is a historical region situated in SW Poland, in the Polish–Czech–German borderland. Thanks to its historical monuments, nature reserves, national parks and beautiful mountain chains, it is one of the more interesting touristic region in Poland.

Different mineralogical assemblages occur in different geological units of Lower Silesia. The most famous mineral localities in Lower Silesia are Strzegom (pegmatite mineralization), Jordanów (nephrite), Szklary (chrysoprase), Lubin (copper deposit). Eight mineral species have the type locality here (Table 1).

Table 1. Mineral species described from Lower Silesia

Mineral name and chemical formula	Type locality	Author and year of discovery
Bohdanowiczite, $AgBiSe_2$	Kletno	Banaś *et al.*, 1979
Chrysotile, $Mg_3Si_2O_5(OH)_4$	Złoty Stok	von Kobell, 1834
Eugenite, $Ag_{11}Hg_2$	Lubin	Kucha, 1986
Hydroniumjarosite, $(H_3O)Fe^{3+}{}_3(SO_4)_2(OH)_6$	Wałbrzych	Kubisz, 1960
Morozeviczite $(Pb,Fe)_3Ge_{1-x}S_4$ (x = 0.18 to 0.69)	Polkowice	Harańczyk, 1975
Polkovicite $(Fe,Pb)_3(Ge,Fe)_{1-x}S_4$ (x = 0.18 to 0.69)	Polkowice	Harańczyk, 1975
Sarcopside $(Fe^{2+},Mn^{2+},Mg)_3(PO_4)_2$	Michałkowa	Websky, 1868
Uranophane $Ca(UO_2)_2(SiO_3OH)_2$□$5H_2O$	Miedzianka	Websky, 1853

2. Geological setting

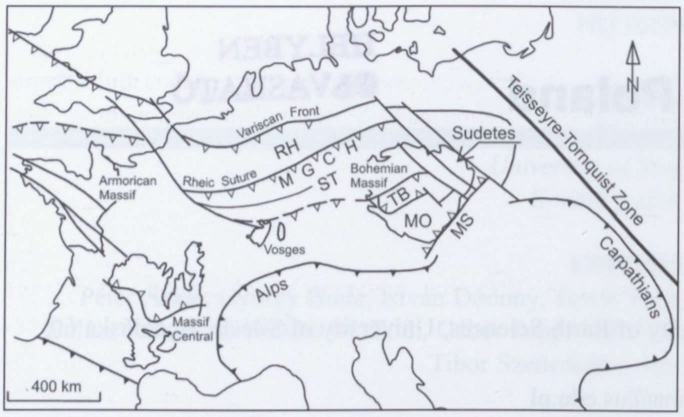

Fig. 1. The Sudetes on the tectonic map of the Variscan Belt of Europe (after Mazur *et al.*, 2006).

MGCH – Mid-German Crystalline High, MO – Moldanubian, MS – Moravo-Silesian, RH – Rhenohercynian, ST – Saxothuringian, TB – Teplá-Barrandian.

The field trip area is located in the NE part of the Bohemian Massif forming the eastern part of the Variscan Belt of Europe (VBE; Fig. 1). VBE represents a classical orogenic system, located between the Caledonian system in the north and the Alpine system in the south. All three orogenic belts border the East European Craton from the west. Saxo-Thuringian, Moldanubian, Teplá-Barrandian, Lugician and Moravo-Silesian units are the main geologic parts of Bohemian Massif (Fig. 2).

In Poland two main parts of Lower Silesia could be distinguished: the Sudetes on SW, forming an uplifted block, and the Fore-Sudetic Block, thrown-down on NE, between the Odra Fault Zone in the NE and Elbe Fault Zone in the SW, parallel to the margin of the East European Craton. These units are divided by the Sudetic Boundary Fault, which was formed during Neogene block deformations (Figs. 2–4). The Fore-Sudetic Block is covered by Cenozoic sedimentary rocks up to 300 m thick. The Sudetes and the Fore-Sudetic Blocks have a complicated geological structure, with mosaic character (Figs. 3 and 4). Lower Silesia is built up by various geolog-

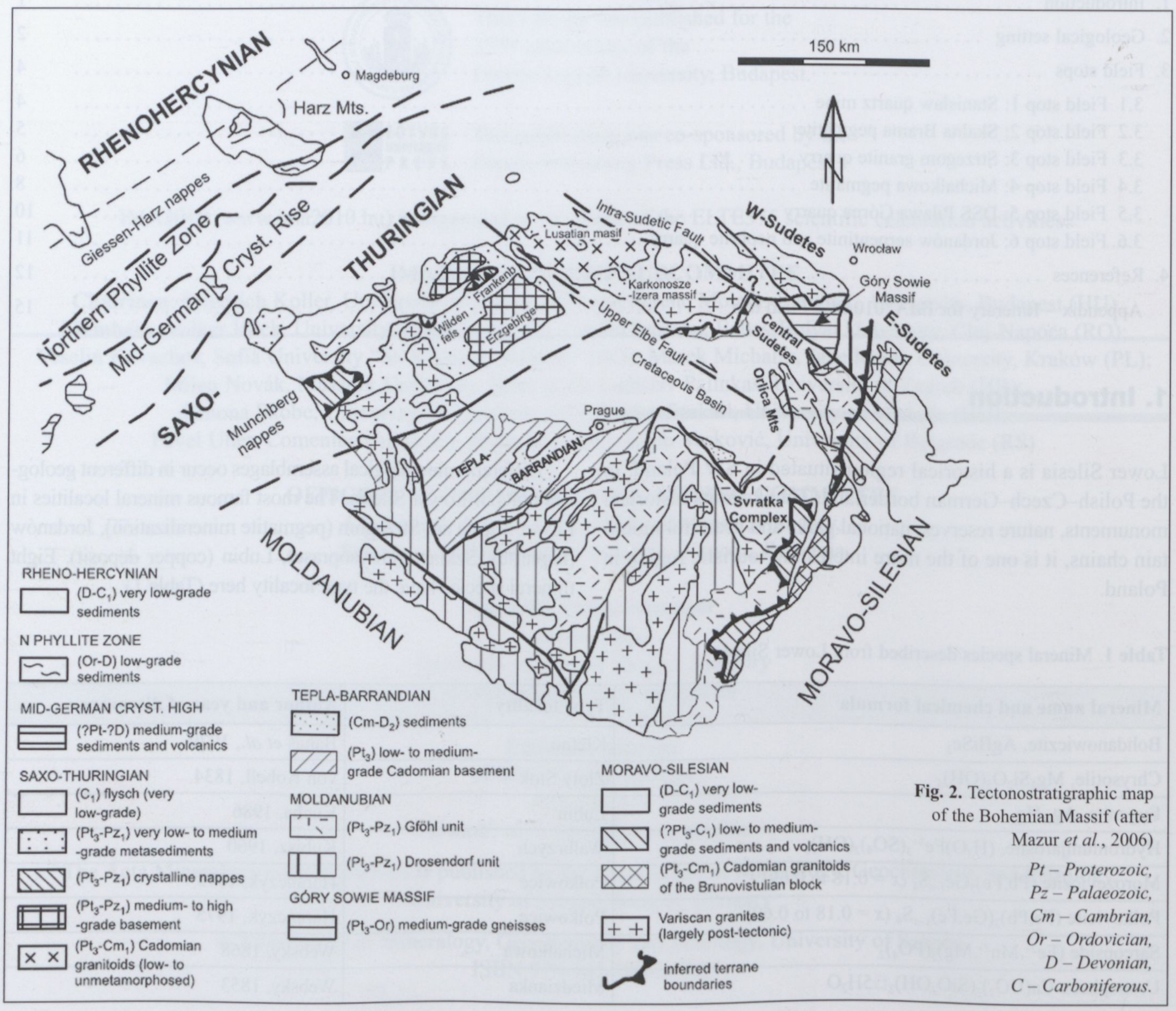

Fig. 2. Tectonostratigraphic map of the Bohemian Massif (after Mazur *et al.*, 2006)

Pt – Proterozoic,
Pz – Palaeozoic,
Cm – Cambrian,
Or – Ordovician,
D – Devonian,
C – Carboniferous.

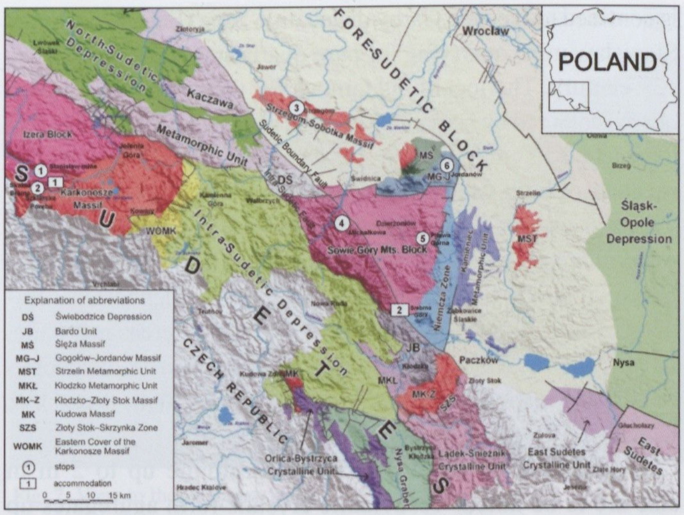

Fig. 3. Map of the geological units of Lower Silesia (after Cwojdziński & Kozdrój, 2007).

ical units from the early Proterozoic to the Quaternary. Mosaic rock-complexes include: non-altered sedimentary rocks, magmatic rocks, and metamorphic ones, metamorphosed in facies from greenschist to granulite and eclogite. In general, boundaries between individual geological units are tectonic in character.

Several structural units could be distinguished in the geological structure of Lower Silesia. The oldest is the **Cadomian basement**, represented by greywackes and granodiorites of the Lusatian Block, gneisses of the Strzelin Massif, metagabbros, amphibolites and metavolcanics of the Kłodzko Metamorphic Complex. The following **pre-Variscan successions and igneous complexes** are represented by the volcano-sedimentary successions of the Kaczawa and South Karkonosze metamorphic units, metasediments of the Bardo Basin and by the Sudetic ophiolites. The **Variscan orogenic unit** is represented by the remnants of tectonic sutures, *i.e.* dismembered ophiolite suite, extensive MORB-type metamorphosed igneous complexes and high pressure metamorphic rocks. Intense granitoid magmatism (Karkonosze Massif, Strzegom-Sobótka Massif) is one of the major features of the Variscan orogenic unit. The uplift, following the main magmatic event, and associated widespread bimodal volcanism between Carboniferous and Permian were the final Variscan tecto-magmatic events. The beginning of the **Post-Variscan evolution** is connected to the development of the thick post-orogenic molasse succession. The major part of the Mesozoic era was characterized by low tectonic activity. In the Upper Cretaceous, the intense tectonic activity caused the subsidence of pre-existing intramontane basins, formation of a

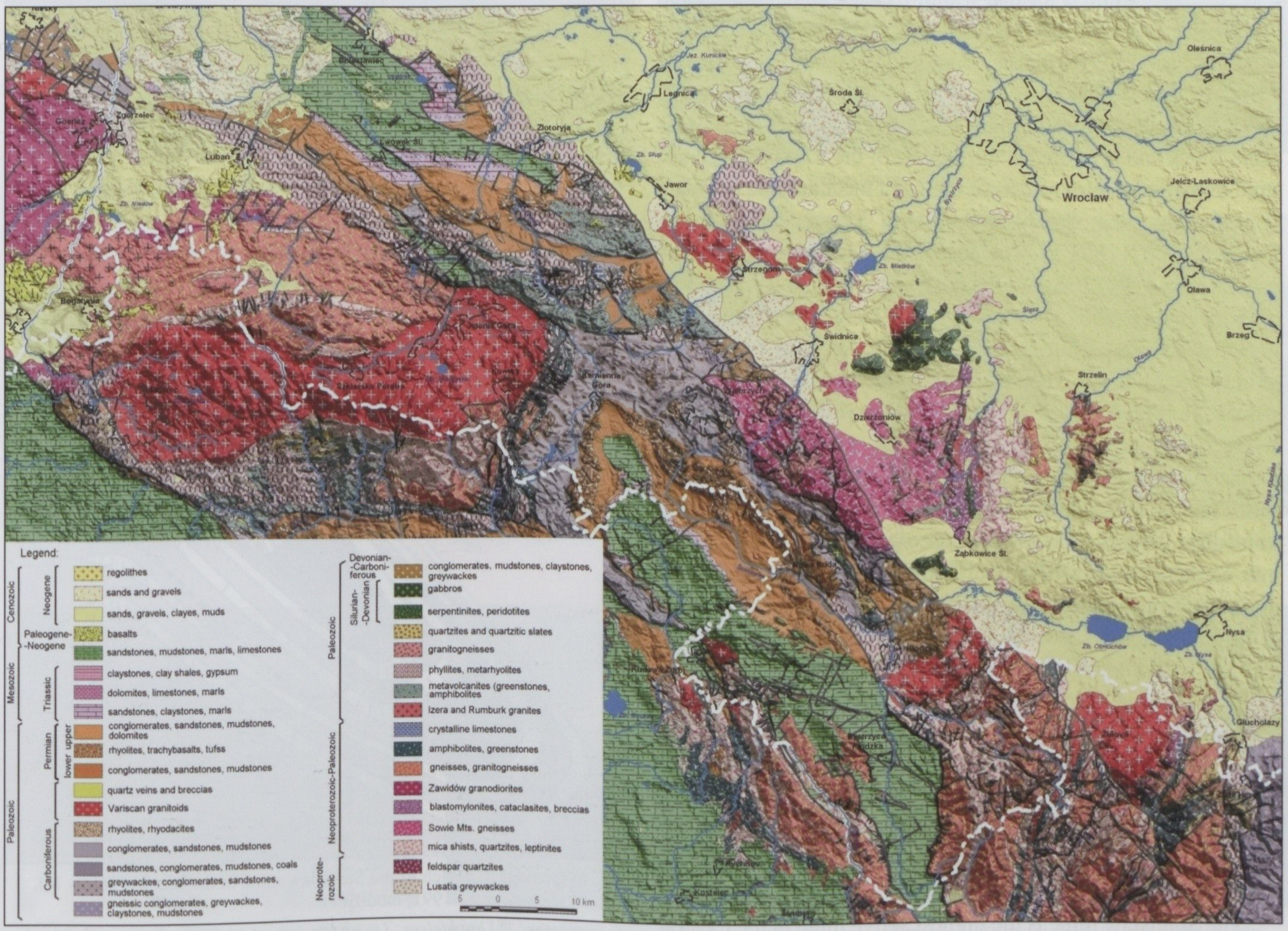

Fig. 4. Generalized geological map of Lower Silesia without Quaternary sediments (after Cwojdziński & Kozdrój, 2007).

new tectonic graben and deposition of a thick (up to 900 m in the Nysa Graben) Upper Cretaceous clastic and marl succession. During an Upper Cretaceous– Paleogene inversion, the Sudetes (Sudety) Block was uplifted along the Odra Fault Zone in the NE and the Elbe Fault Zone in the SW. In the Miocene, thicker sediments of shallow marine sands and clays, containing brown coal were deposited. At the same time, basaltic volcanism was widespread throughout the area as the part of Central European volcanic province. The final uplift of the SW segment of the Sudetes, along the Sudetic Boundary Fault, took place in the Pliocene and was recorded in the Sudetic foreland by sedimentation of gravels.

3. Field stops

3.1 Field stop 1: Stanisław quartz mine

GPS coordinates: *N 50°51'10.5", E 15°26'25.7", 1001 m*
Key words: *quartz vein, skarn, hornfels, wollastonite, grossular, vesuvianite, diopside-hedenbergite, apophyllite, stilbite, vanadinite, mottramite*

The Stanisław mine is located within Izerskie Garby dislocation zone between hornfelses of the Szklarska Poręba belt (in SE) and gneisses (in NW) of the Karkonosze-Izera Block, and Karkonosze granitoid massif (in S) (Lewowicki, 1965) (Figs. 1, 2, 4). Szklarska Poręba hornfels belt belong to the Karkonosze-Izera Block and is located at the contact of the Karkonosze granitoid massif with mica schists of the Izera metamorphic complex (Borkowska, 1966; Smulikowski, 1972; Mazur, 2002; Oberc-Dziedzic, 2007) (Fig. 5). The age of the Karkonosze granite is estimated at 329±17 Ma on the basis of isochrone Rb-Sr whole rock method (Duthou *et al.*, 1991). The Izera Block consists of gneisses, granite-gneisses and granites, pre-Variscan in age. The granitic protolith was dated by different methods on 515-480 Ma (Rb-Sr: Borkowska *et al.*, 1980; U-Pb: Korytowski *et al.*, 1993; U-Pb: Oliver *et al.*, 1993; Żelaźniewicz, 1997; single zircon: Kröner *et al.*, 2001). Within gneisses and granites several belts of mica schists are present. Szklarska Poręba schist belt, at the immediate contact to the Karkonosze granite, was transformed into cordierite-andalusite-biotite hornfelses and Ca skarns. The age of contact metamorphism is dated at 333 ± 4 Ma on the basis of Rb-Sr whole-rock isochron (Fila-Wójcicka, 2004). Pegmatites and late hydrothermal veins are cutting the metamorphic rocks.

The Izerskie Garby dislocation runs in the distance of a few kilometers from Jastrzębia Góra in NE through Piaskowa Góra, Rozdroże Izerskie, Izerskie Garby into the Karkonosze granite on S-side of Wysoka Kopa. The dislocation is dipping steeply (65°) to SE and its width ranges between 100 and 300 m (Szałamacha, 1965; Szałamacha & Szałamacha, 1966). Quartz is a predominant mineral filling.

The Stanisław mine is the highest active mine in the Central Europe (1088 m asl). Quartz mineralization exploited in the mine is confined to Izerskie Garby dislocation zone (Figs. 5–7). In the Stanisław mine quarrying for pure quartz started as early as the 13th century. The locality is famous for the specimens of pink quartz, coloured by hematite (Fig. 8). The largest pink quartz crystal reached 50 cm in length. Apart from quartz veins, a quartzitization of both gneisses and hornfelses is noteworthy.

Ca skarns and hydrothermal veins are the most interesting mineralogical object in the Stanisław mine. Wollastonite, grossular–andradite, vesuvianite, diopside–hedenbergite, epidote, calcite, fluorite are the main minerals, whereas monazite, zircon, titanite, allanite, calcite, pyrrhotite, pyrite, chalcopyrite are the main accessories (Fila-Wójcicka, 2000; Pieczka & Kraczka, 1998; Karwowski *et al.*, 1996).

Aggregates of white massive wollastonite up to 2 m in size are to be noted. Vesuvianite crystals form aggregates up

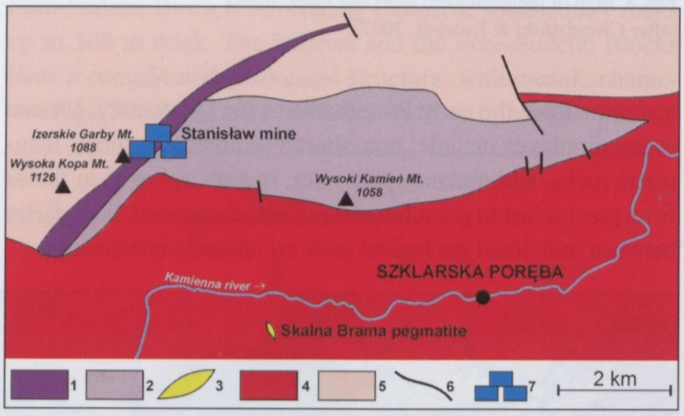

Fig. 5. Geological map of the Szklarska Poręba belt without Quaternary sediments (after Kozłowski, 2002, modified).
1 – quartz vein, 2 – hornfelses, 3 – pegmatites, 4 – Karkonosze granites, 5 – Izera gneisses and granites, 6 – faults, 7 – quarry.

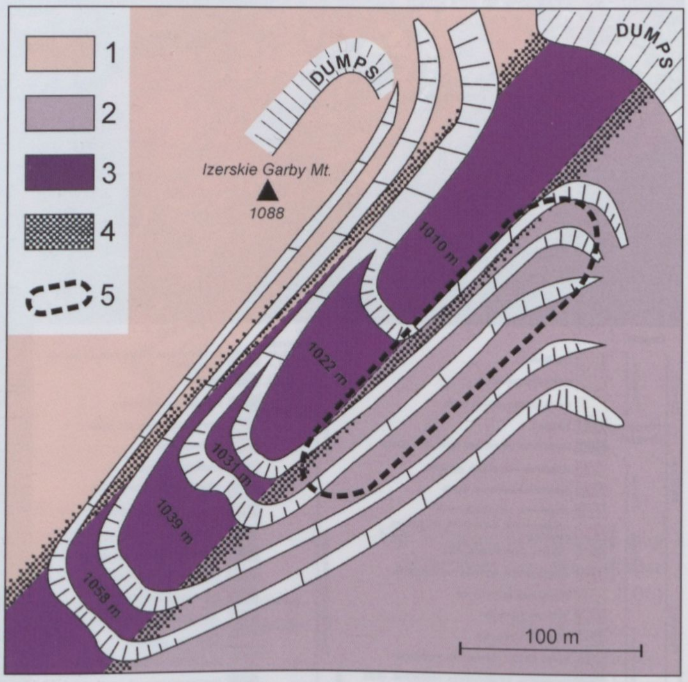

Fig. 6. Geological sketch of the Stanisław mine in the Izerskie Garby Mt. (after Janeczek *et al.* 1991, modified).
1 – gneisses, 2 – hornfelses, 3 – quartz vein, 4 – silicified zone, 5 – outcrop of skarns.

Fig. 7. View to the Stanisław mine.

Fig. 8. Pink quartz group (10 cm high), Stanisław mine.

Fig. 9. Wollastonite skarn nest within quartzitised hornfels, Stanisław mine.

Fig. 10. Massive wollastonite, Stanisław mine.

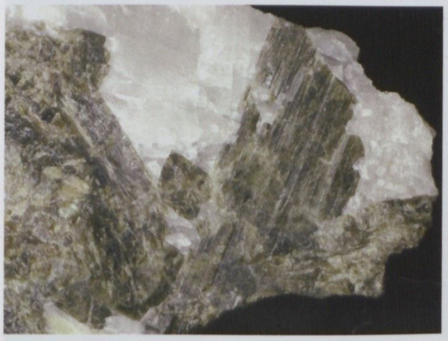

Fig. 11. Vesuvianite, Stanisław mine.

Fig. 12. Grossular, Stanisław mine.

Fig. 13. Vanadinite crystals up to 2 mm in length, Stanisław mine.

Fig. 14. Mottramite, field of view 2 × 2.5 cm, Stanisław mine.

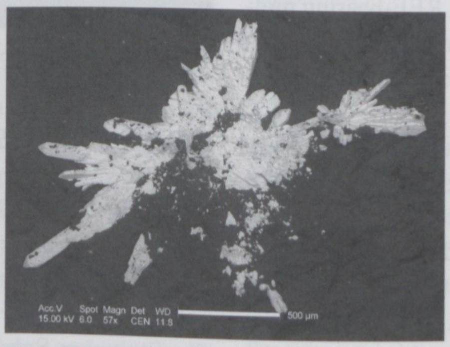

Fig. 15. Vanadinite, BSE image, made in low vacuum, Stanisław mine.

Fig. 16. Mottramite, BSE image, made in low vacuum, Stanisław mine.

to 20 cm. Xenomorphic garnet blasts are up to 3 cm in diameter, while idiomorphic garnet crystals reach 1 cm in size (Figs. 9–12).

In the Stanisław mine numerous vein-like pegmatite bodies occur. Minerals such as: tourmaline, rutile, apatite, chlorite, löllingite, native bismuth, cassiterite, scheelite, feldspar, muscovite, biotite, fluorite, zircon, monazite, xenotime were described from these formations by Długoszewska (2005).

A late hydrothermal fluorite-fluorapophyllite-quartz-calcite-stilbite-chlorite mineralization is also present (Kozłowski, 1978). Recently, vanadinite (Szełęg, 2008) and mottramite (Szełęg & Gałuskina, 2008) were discovered in the hydrothermal mineralization (Figs. 13–16).

Andalusite crystals up to 3 cm in length, schörl and "pinite" pseudomorphs after cordierite occur within hornfelses.

3.2 Field stop 2: Skalna Brama pegmatite

GPS coordinates: *N 50°49'28.1", E 15°28'47.7", 812 m*
Key words: *REE-pegmatite, zirconolite, gadolinite, fergusonite–formanite, aeschynite, monazite, zircon, xenotime*

The Skalna Brama pegmatite is situated within the Karkonosze granitoid massif. The Karkonosze granitoid massif is located at the border of Poland and the Czech Republic, as a part of the Bohemian Massif. It is elongated mass reaches ~70 km in W–E, and nearly 22 km in the N–S direction (Figs. 1–2). The age of the Karkonosze granite is estimated at 329±17 Ma on the basis of isochrone Rb-Sr whole rock method (Duthou *et al.*, 1991). Biotite granite is a predominant rock type of the granitoid massif (Borkowska, 1966).

The Skalna Brama pegmatite is located close to the road from Szklarska Poręba to Jakuszyce and Harrachov (Czech Republic) (Fig. 5). It forms a lens-like body up to 5 m thick. Its internal structure comprise (from the rim to the core) a biotitic zone, a granitic and graphic zone, a blocky a K-feldspar zone and a massive quartz core. Quartz, microcline, oligoclase, biotite are the rock-forming minerals of the pegmatite. Ilmenite, chlorite, hematite, gadolinite, fergusonite, monazite, zircon, zirconolite, xenotime, uraninite, pyrite, arsenopyrite and uranophane are accessory minerals (Figs. 18–21). REE-bearing minerals from the Skalna Brama pegmatite were reported by Websky (1865), Traube (1888), Gajda (1960 a,b) Kozłowski & Sachanbiński (2007) and Szełęg & Škoda (2008).

The pegmatite has been since 18th century up to the early 20th century for quartz, used by the local glassworks, and for K-feldspar for ceramics production. Up to the present, the quartz core has been completely exploited. The hole size is near 6 m in diameter and up to 4 m in depth with short stone drifts reaching up to 10 m in length (Fig. 17). Close to the drift, on small spoil heaps, one can find samples of pegmatite with REE minerals.

Fig. 17. Skalna Brama pegmatite.

Fig. 18. Ilmenite, Skalna Brama pegmatite.

Fig. 19. Zirconolite (8 cm in height), Skalna Brama pegmatite.

3.3 Field stop 3: Strzegom granite quarry

GPS coordinates: *N 50°58'5.61", E 16°19'6.09", 270 m*
Key words: *granite quarry, granite pegmatite, quartz, microcline, albite, epidote, stilbite, chabazite, bavenite, titanite*

The Strzegom-Sobótka massif is explored for granite rocks for centuries. Currently, near 60 working quarries could be found

Fig. 20. Monazite (0.5 cm in size), Skalna Brama pegmatite.

Fig. 21. Fergusonite (1.5 cm in length), Skalna Brama pegmatite.

Fig. 22. Strzegom granite quarry.

within this massif (Fig. 22). The massif is situated in the central part of the Fore-Sudetic Block. It is about 50 km in length in the SW–NE direction, and 20 km in width (Figs. 3–4). Hornblende-biotite monzogranite and biotite monzogranite form the western part of the Strzegom-Sobótka massif, whereas biotite granodiorite, two-mica monzogranite and small bodies of tonalite and alaskite form the eastern part (Majerowicz, 1972; Puziewicz, 1989) (Fig. 23). Igneous activity in this area occurred from Upper Carboniferous till Lower Permian. Generally, most of the granitic bodies formed at 310–294 Ma (zircon Pb-evaporation: Turniak *et al.*, 2005; Re-Os age for molybdenite: Mikulski & Stein, 2007). On the basis of the Rb-Sr method, Pin *et al.* (1989) reported an older age of 324 ± 7 Ma for the two-mica monzogranite.

Miarolitic pegmatites with hydrothermal mineralization are well known to mineralogists (Schwantke 1896; Żabiński, 1953; Lenkowski, 1983; Janeczek, 1985; Ciesielczuk *et al.*, 2008). Pegmatite veins, appearing mostly in the eastern part of the massif, are also important mineralogically (Janeczek & Sachanbiński, 1989). In the Strzegom pegmatites more than 90 mineral species were described (Table 2).

Various types of miarolitic pegmatites occur in the western part of Strzegom-Sobótka massif. Typical miarolitic pegmatites, sometimes surrounded by biotite schlieren, are composed of the following concentric zones: aplitic, graphic quartz-feldspar intergrowths, blocky microclines, idiomorphic microclines and quartz core (Figs. 24–25) (Janeczek, 2007).

The cavities may be empty or are filled by clay minerals or carbonates. The size of pegmatite bodies vary from few cms to 2 m. Idiomorphic crystals of quartz, feldspars and other minerals are on the walls of the cavities (Figs. 26–30).

Table 2. List of pegmatite minerals of the Strzegom-Sobótka massif.

Native elements
bismuth

Sulphides
arsenopyrite
bismuthinite
bornite
chalcocite
chalcopyrite
cosalite
covellite
enargite
galena
marcasite
molybdenite
pyrite
pyrrhotite
sphalerite
valleriite

Oxides
anatase
cassiterite
cryptomelane
fergusonite-(Y)
ferrocolumbite
formanite-(Y)
gahnite
goethite
hematite
magnetite
columbite-(Mn)
rutile
tantalaeschynite-(Y)
tantalite-(Fe)
uraninite

Halides
fluocerite-(Ce,La)
fluorite

Carbonates
bastnäsite-(Ce)
bismutite
calcite
malachite
parisite-(Ce)
siderite
synchysite-(Ce)

Phosphates
fluorapatite
monazite-(Ca)
xenotime-(Y)

Tungstates & Molybdates
ferberite–hübnerite series
scheelite
wulfenite

Silicates
albite
allanite-(Ce)
apophyllite (pseudomorphs)
babingtonite
bavenite
beryl
biotite group
celadonite
chabazite
chamosite
chrysocolla
clinochlore
clinozoisite
cordierite
epidote
fayalite
ferroaxinite
gadolinite-(Y)
genthelvite
greenalite
grunerite
helvite
heulandite
hornblende
hastingsite
laumontite
lepidolite
lepidomelane
microcline
milarite
minnesotaite
montmorillonite
muscovite
nontronite
oligoclase
opal-AN
phenakite
phlogopite
prehnite
pumpellyite-(Fe^{2+})
quartz
schörl–dravite series
scolecite
spessartine–almandine series
stilbite
thorite
thortveitite
titanite
topaz
zinnwaldite
zircon

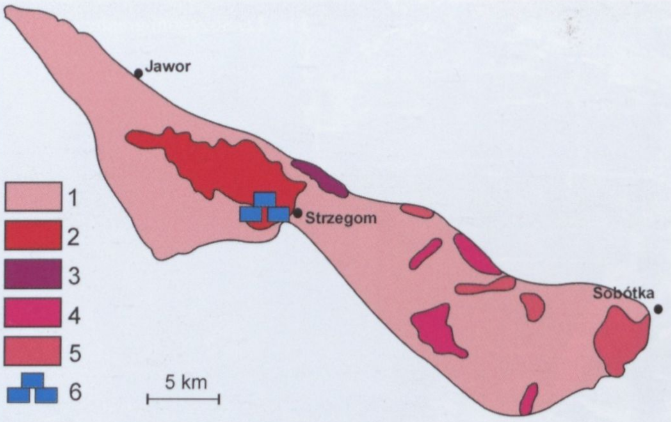

Fig. 23. Generalized geological map of the Strzegom-Sobótka massif (after Puziewicz, 1989)

1 – granites under sedimentary cover, 2 – biotite-hornblendic monzogranite, 3 – biotitic monzogranite, 4 – two-mica monzogranite, 5 – biotitic granodiorite 6 – quarry.

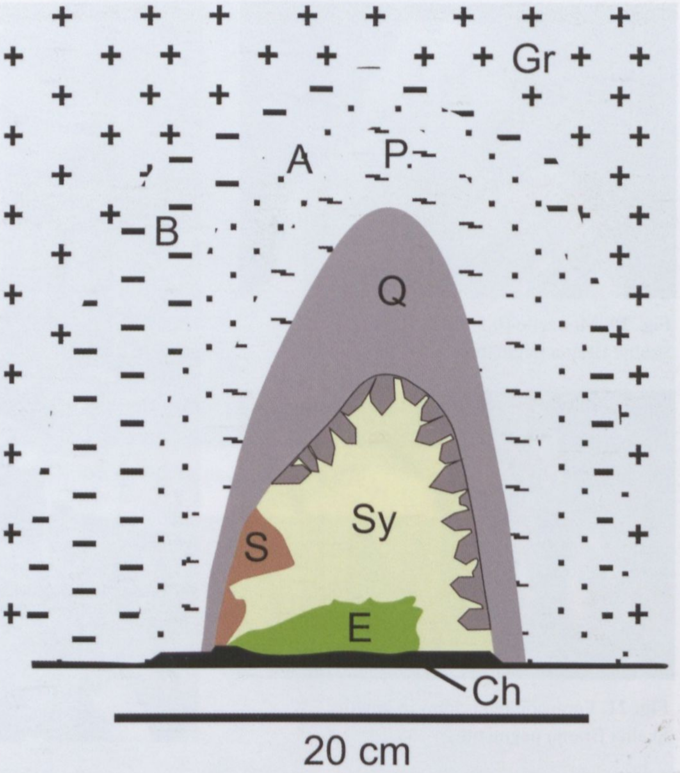

Fig. 24. Schematic cross-section through a zoned miarolitic pegmatite from the Żółkiewka quarry (after Janeczek, 2007).

Gr – monzogranite, B – biotite schlieren, A – aplitic zone, P – quartz-feldspar graphic intergrowths, Q – quartz core, Sy – siderite, S – stilbite, E – epidote, Ch – chlorite.

3.4 Field stop 4: Michałkowa pegmatite

GPS coordinates: *N 50°43'38.42", E 16°26'55.49", 521 m*
Key words: *granite pegmatite, sarcopside type locality, graftonite, schorl–dravite*

The Michałkowa pegmatite is located in the NW part of the Góry Sowie Mts. block on Dział Michałkowski Hills, close to Bystrzyckie Lake (Fig. 31). The Góry Sowie Mts. block is situated in the central part of Lower Silesia. The Intra-Sudetic Fault borders the block from the south-west, while the Niemcza Zone from the east, and the Świebodzice Depression, Strzegom-Sobótka Massif and Gogołów-Jordanów Massif from the north. In the Neogene the block was cut by the Sudetic Boundary Fault into two elements: the Góry Sowie Mts. on the west and its foreland on the east (part of the Fore-Sudetic Block) (Figs. 3 and 4).

Fig. 25. Zoned miarolitic pegmatite, Strzegom.

Fig. 26. Smoky quartz, microcline, albite druse (12 cm high), Strzegom.

Fig. 27. Epidote, Strzegom.

Fig. 28. Stilbite (picture width 15 cm), Strzegom.

Fig. 29. Fluorite (crystal size 1.5 cm), Strzegom.

Fig. 30. Topaz (crystal size 1 cm), Strzegom.

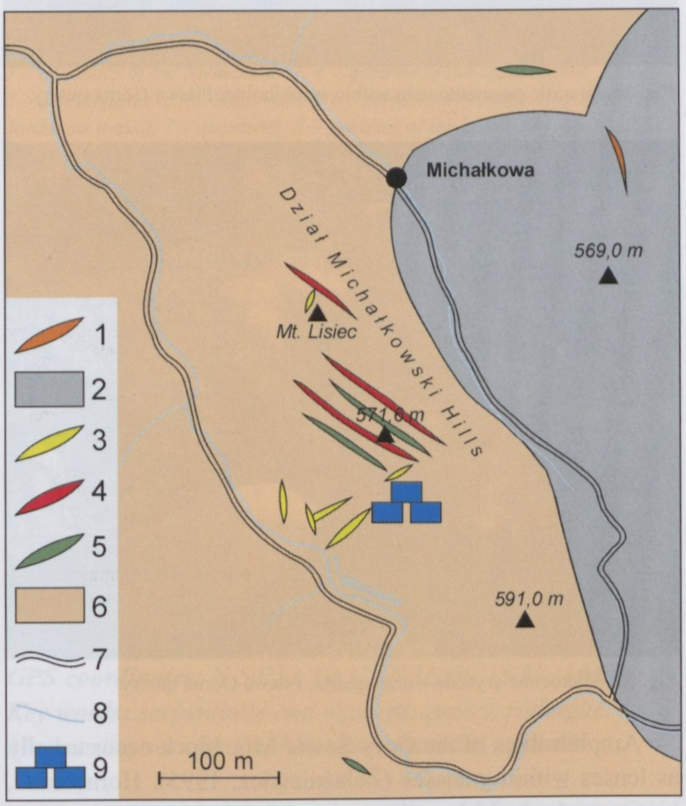

Fig. 31. Generalized geological map of Michałowice area without Quaternary sediments (after Grocholski, 1956).

1 – kersantites, 2 – gneissic conglomerates, 3 – pegmatites, 4 – hyperites, 5 – amphibolites, 6 – gneisses and migmatites, 7 – roads, 8 – rivers, 9 – quarry.

Oligoclase-biotite paragneisses, migmatites and orthogneisses are dominant rocks of the block, with minor amphibolites, serpentinites, granulites, calc-silicate rocks, pegmatites and quartz veins (Kryza, 1981; Żelaźniewicz, 1987, 1990). The typical components of gneisses and migmatites are quartz, oligoclase and biotite. Sillimanite, muscovite, K-feldspars, cordierite, andalusite, garnet, kyanite, apatite, zircon, monazite, magnetite, hematite are accessory minerals. The protoliths for the para-gneisses were greywackes and various types of pelitic-psammitic sediments (Kryza, 1981; Żelaźniewicz, 1987).

The pegmatites occur as veins, lenses or nests, located within the gneisses and amphibolites. Two genetic types of pegmatites were observed. The first (older) – small bodies parallel or nearly parallel to the host rocks foliation, and the second (younger) – veins and lenses cutting discordantly the host rocks (Smulikowski, 1953). The Michałkowa pegmatite is representing the first type of pegmatites. Probably that type was formed as a result of partial melting (anatexis) of some rock components during migmatization processes (Kryza, 1977; Pieczka, 2000). On the basis of Rb-Sr and U-Pb isotopic studies, the age of the Góry Sowie Mts. pegmatites was determined at 370 ± 4 Ma (Van Breemen *et al.*, 1988).

Michałkowa pegmatite was exploited in 19th century for quartz. In the place of historical exploitation the small adit and heap are left, the minerals could be collected from the dump (Fig. 32).

The first studies of the minerals of the pegmatite were published by German mineralogists (Websky, 1868; Traube, 1888;

Fig. 32. View of the remains of Michałkowa pegmatite.

Fig. 33. Schorl (5 cm in length), Michałkowa pegmatite.

Fig. 34. Sarcopside (2 cm in size), Michałkowa pegmatite.

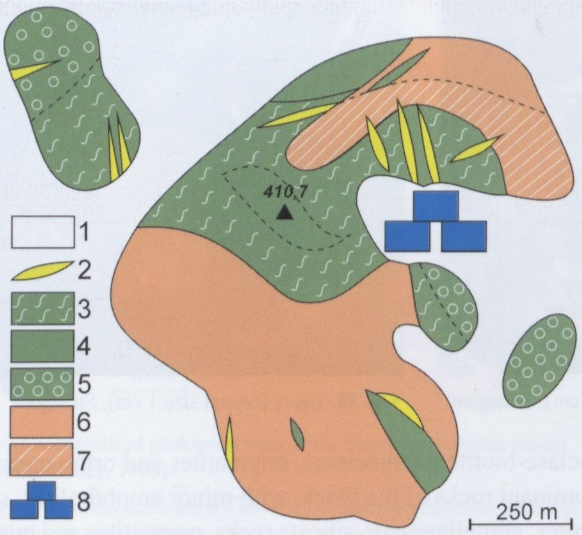

Fig. 35. Geological map of Piława Górna quarry (after Cymerman & Walczak-Augustyniak, 1986).
1 – Quaternary sediments, 2 – pegmatites, 3 – amphibolites and gneisses, 4 – amphibolites, 5 – garnet amphibolites, 6 – migmatites, 7 – migmatites and gneisses, 8 – quarry.

Dathe & Finckh, 1924). Main rock-forming minerals are microcline, albite, quartz, biotite and muscovite. Schorl (Fig. 33), apatite and garnet are accessory minerals. In 1868, Websky described the new mineral species sarcopside $(Fe^{2+},Mn^{2+},Mg)_3(PO_4)_2$ just from the Michałkowa pegmatite. Sarcopside occurs within albite as reddish-brown lenses or anhedral grains up to 4 cm in size (Fig. 34). Vivianite pseudomorphs after sarcopside could also be observed.

3.5 Field stop 5: Piława Górna quarry

GPS coordinates: *N 50°42'11.6", E 16°44'13.1", 359 m*
Key words: *amfibolite and migmatite quarry, granite pegmatite, quartz, microcline, albite, muscovite, biotite, beryl, almandine–spessartine, columbite-(Fe)*

The Piława Górna quarry is located in the eastern part of the Góry Sowie Mts. foreland, within the Fore-Sudetic block (Figs. 3 and 4). In the quarry, high quality amphibolites and migmatites are mined (Fig. 35), for road building purposes.

Fig. 36. Granitic pegmatite vein within amphibolite, Piława Górna quarry.

Fig. 37. Microcline crystals within quartz, Piława Górna quarry.

Amphibolites of the Góry Sowie Mts. block occur usually as lenses within gneisses (Żelaźniewicz, 1995). Hornblende, biotite and plagioclase (andesine–labradorite) are the main rock-forming minerals. Almandine, diopside and quartz are accessory minerals (Żelaźniewicz, 1987). The origin of these amphibolites might be related to fractionation of mantle material, which intruded during midcrustal (10–12 km) deformation (Dziedzicowa, 1994; fide Budzyń *et al.*, 2004). In the

Fig. 38. Schorl, Piława Górna quarry.

Fig. 39. Beryl and schorl, Piława Górna quarry.

Fig. 40. Columbite-(Fe) and almandine, Piława Górna quarry.

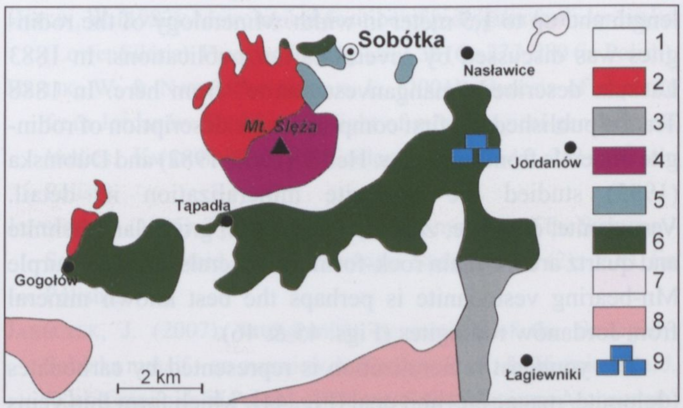

Fig. 41. Generalized geological map of Gogołów-Jordanów serpentinite massif (after Gałuskin & Szełęg, 2003).

1 – Cenozoic sediments, 2 – granites of the Strzegom-Sobótka massif, 3 – mylonites of the Niemcza zone, 4 – gabbros of the Ślęża massif, 5 – amphibolites of the Ślęża massif, 6 – serpentinites of the Gogołów-Jordanów massif, 7 – quartzites, 8 – gneisses of the Sowie Mts. block, 9 – quarry.

2008–2009 a few pegmatite bodies were found within amfibolite of the DSS Piława Górna quarry (Fig. 36). These pegmatites are now under study.

The pegmatites form veins up to 50 m in length and up to 4 m in width. K-feldspar, albite, quartz, biotite and muscovite are the main rock-forming minerals (Fig. 37). Schorl, almandine, beryl, columbite-(Fe), zircon, monazite, xenotime, fluorapatite, cassiterite, uraninite are accessory minerals (Figs. 38–40).

3.6 Field stop 6: Jordanów serpentinite and nephrite quarry

GPS coordinates: *N 50°52'19.3", E 16°50'15.5", 164 m*
Key words: *serpentinite and nephrite quarry, rodingite, Mn-bearing vesuvianite, hibschite, prehnite, opal-AN*

The Jordanów serpentinite quarry is situated in the eastern part of the Gogołów-Jordanów serpentinite massif (Fig. 41).

That massif is one of the numerous dispersed parts of the so-called Sudety ophiolite (Majerowicz, 1979; Narębski *et al.*, 1982; Gunia, 1992; Dubińska, 1995; Dubińska & Gunia, 1997).

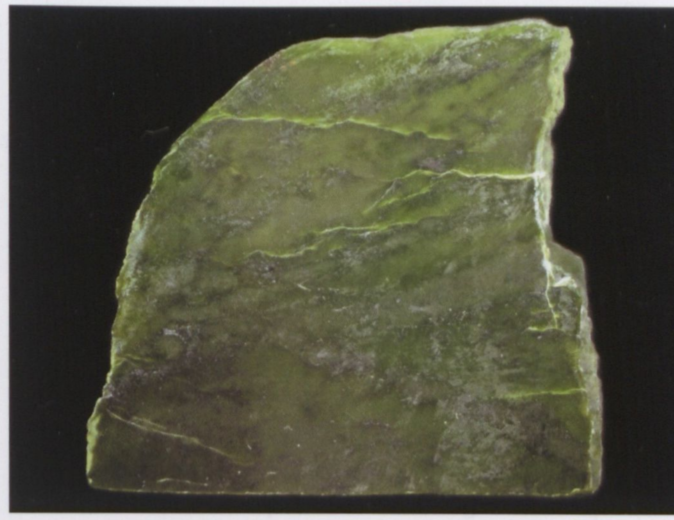

Fig. 42. Nephrite (15 cm high), Jordanów serpentinite quarry.

Fig. 43. Northern wall of Jordanów serpentinite quarry with rodingite lens.

The serpentinization epizode was dated by U-Pb on zircon grains for 400 ±3-4 Ma by Dubińska *et al.* (2004). Serpentinites were formed by a transformation of harzburgites and lherzolites (Dubińska & Gunia, 1997). Inside the Gogołów-Jordanów serpentinite massif, rodingite bodies were found (Majerowicz, 1979, 1984; Heflik, 1982; Dubińska, 1989, 1995, 1997). Taking into account the protolith, two types of rodingites were distinguished here: boninitic rodingites and albite-plagiogranitic ones. In the boninitic rodingites, relics of clinopyroxene, vesuvianite, garnet and diopside were found (Dubińska, 1995, 1997; Dubińska & Gunia, 1997; Dubińska *et al.*, 2004). From the

Fig. 44. Opal-AN (picture width 5 cm), Jordanów serpentinite quarry.

Fig. 45. Massive Mn-bearing vesuvianite (6 cm high), Jordanów serpentinite quarry.

Fig. 46. Mn-bearing vesuvianite crystals (up to 3 mm in length), Jordanów serpentinite quarry.

plagiogranitic rodingites, relics of chessboard albite and hydrogrossular, clinozosite, zosite and late diopside were reported (Dubińska, 1989, 1995; Dubińska *et al.*, 2004).

Jordanów is one of the oldest serpentinite quarries in Europe. It is a famous locality for nephrite. The first description of nephrite from Jordanów was published by Traube (1885). Results of detailed studies of the Jordanów nephrite were recently reported by Heflik & Natkaniec-Nowak (2001). In the past, big blocks of nephrite were exploited here. Today tremolite–actinolite nephrite is very rarely found in the quarry (Fig. 42), but small specimens may be found in the waste material.

Within the serpentinite exposed by this quarry, rodingite bodies occur (Fig. 43). Rodingites form lenses up to few m in length and up to 1,5 meter in width. Mineralogy of the rodingites was discussed by several earlier publications. In 1883 Lasaulx described "manganvesuvianite" from here. In 1888 Traube published the first comprehensive description of rodingite minerals from Jordanów. Heflik (1967, 1982) and Dubińska (1995) studied the rodingite mineralization in detail. Vesuvianite, diopside, zoisite, clinozoisite, grossular, phehnite and quartz are the main rock-forming minerals. Pinkish-purple Mn-bearing vesuvianite is perhaps the best known mineral from Jordanów rodingites (Figs. 45 & 46).

The youngest mineralization is represented by carbonates (dolomite, magnesite) and opal (Fig. 44), which form thin veins cutting serpentinites and rodingites.

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Appendix – Itinerary for IMA2010 PL2 Field trip

Monday, Aug. 16, 2010 (Day 1, ~300 km)

Transfer from Katowice airport and Katowice railway station (Meeting point 1) and Kraków airport (Meeting point 2) to Szklarska Poręba (Lower Silesia).

19:00	Accommodation and dinner in Szklarska Poręba.

Tuesday, Aug. 17, 2010 (Day 2, ~30 km)

08:00–08:30	Travel to Stanisław quarry
08:30–11:30	Stanisław quarry
11:30–12:00	Travel to Skalna Brama pegmatite
12:00–13:30	Skalna Brama pegmatite
13:30–13:45	Travel to Szklarska Poręba
13:45–15:00	Visit to the local mineralogical museum and
16:00–	Accommodation and dinner in Szklarska Poręba

Wednesday, Aug. 18, 2010 (Day 3, ~150 km)

08:00–09:30	Departure from Szklarska Poręba and travel to Strzegom quarry
09:30–11:30	Strzegom quarry
11:30–13:00	Travel to Michałkowa pegmatite
13:00–15:00	Michałkowa pegmatite
15:00–16:30	Travel to Srebrna Góra
16:30–	Accommodation and dinner in Srebrna Góra

Thursday, Aug. 19, 2010 (Day 4, ~100 km)

08:00–09:00	Travel to Piława Górna quarry
09:00–12:00	Piława Górna quarry
12:00–13:00	Travel to Jordanów quarry
13:00–15:00	Jordanów quarry
15:00–16:00	Arive to Srebrna Góra
16:00–	Accommodation and dinner in Srebrna Góra

Friday, Aug. 20, 2010 (Day 5, ~650 km)

09:00	Transfer from Srebrna Góra to Budapest by minibus (departure after breakfast)
13:00	Lunch in Czech Republic
18:00	Accomodation in Budapest

USEFUL NOTES

INSTRUCTIONS FOR AUTHORS

General

Acta Mineralogica-Petrographica (AMP) publishes articles (papers longer than 4 printed pages but shorter than 16 pages, including figures and tables), notes (not longer than 4 pages, including figures and tables), and short communications (book reviews, short scientific notices, current research projects, comments on formerly published papers, and necrologies of 1 printed page) dealing with crystallography, mineralogy, ore deposits, petrology, volcanology, geochemistry and other applied topics related to the environment and archaeometry. Articles longer than the given extent can be published only with the prior agreement of the editorial board.

In the form of two subseries, AMP publishes materials of conferences (AMP Abstract Series) and field guides (AMP Field Guide Series), or, occasionally supplement issues related to other scientific events.

The journal accepts papers that represent new and original scientific results, which have not appeared elsewhere before, and are not in press either.

All articles and notes submitted to AMP are reviewed by two referees (short communications will be reviewed only by one referee) and are normally published in the order of acceptance, however, higher priority may be given to Hungarian researches and results coming from the Alpine-Carpathian-Dinaric region. Of course, the editorial board does accept papers dealing with other regions as well, let they be compiled either by Hungarian or foreign authors.

The manuscripts (prepared in harmony of the instructions below) must be submitted to the Editorial Office in triplicate. All pages must carry the author's name, and must be numbered. At this stage (revision), original illustrations and photographs are not required, though, quality copies are needed. It is favourable, if printable manuscripts are sent on disk, as well. In these cases the use of Microsoft Word or any other IBM compatible editing programmes is suggested.

Language

The language of AMP is English.

Preparation of the Manuscript

The different parts of the manuscript need to meet the instructions below:

Title

The title has to be short and informative. No subtitles if possible. If the main title is too long, an additional shortened title is needed for the running head.

Author

The front page has to carry (under the main title) the full name(s) (forename, surname), affiliation(s), current address(es), e-mail address(es) of the author(s).

Abstract and keywords

The abstract is required to be brief (max. 250 words), and has to highlight the aims and the results of the article. The abstracts of notes are alike (but max. 120 words). As far as possible, citations have to be avoided.

The abstract has to be followed by 4 to 10 keywords.

Text and citations

The format of the manuscripts is required to be: double-spacing (same for the abstract), text only on one side of the page, size 12 Times New Roman fonts. Margin width is 2.5 cm, except the left margin, which has to be 3.5 cm wide. Underlines and highlights ought not be used. Please avoid the use of foot and end notes. Accents of Romanian, Slovakian, Czech, Croatian etc. characters must be marked on the manuscript clearly.

When compiling the paper an Introduction – Geological setting – Materials and Methods – Results – Conlclusions structure is suggested.

The form of citations is: the author's surname followed by the date of publication e.g. (Szederkényi, 1996). In case of two authors: (Rosso and Bodnar, 1995) If there are more than two authors, after the first name the co-authors must be denoted as "et al.", e.g. (Roser et al., 1980).

References

The reference list can only consist of published papers, M.Sc., Ph.D. and D.Sc. theses, and papers in press.

Only works cited previously in the text can be put in the reference list. Examples:

Best, M.G., Christiansen, E.H. (eds.) (2001): Igneous petrology. Blackwell, Edinburgh, 458p.

Upton, B.G.J., Emeleus, C.H. (1987): Mid-Proterozoic alkaline magmatism in southern Greenland: the Gardar province. In: Fitton, J.G., Upton, B.G.J. (eds.): Alkaline Igneous Rocks. Blackwell, Edinburgh, 449–472.

Rosso, K.M., Bodnar, R.J. (1995): Microthermometric and Raman spectroscopic detection limits of CO_2 in fluid inclusions and the Raman spectroscopic characterization of CO_2. Geochimica et Cosmochimica Acta, **59**, 3961-3975.

Szederkényi, T. (1996): Metamorphic formations and their correlation in the Hungarian part of Tisia Megaunit (Tisia Megaunit Terrane). Acta Mineralogica-Petrographica, **37**, 143-160.

Bakker, R.J. (2002): http://www.unileoben.ac.at/~buero62/minpet/Ronald/Programs/Computer.html. Accessed: June 15, 2003.

The full titles of journals ought to be given. In case more works of the same author are published in the same year, then these has to be differentiated by using a, b, etc. after the date.

Illustrations

Finally, each figure, map, photograph, drawing, table has to be attached in three copies, they must be numbered and carry the name of the author on their reverse. All the illustrations ought to be printed on separate sheets, captions as well if possible. Foldout tables and maps are not accepted. In case an illustration is not presented in digital form then one of the copies has to be submitted as glossy photographic print suitable for direct reproduction. Photographs must be clear and sharp. The other two copies of the illustrations can be quality reproductions. Coloured figure, map or photograph can only be published at the expense of the author(s).

The width of the illustrations can be 56, 87, 118, or 180 mm. The maximum height is 240 mm (with caption).

All figures, maps, photographs and tables are placed in the text, hence, it is favourable if in case of whole page illustrations enough space is left on the bottom for inserting captions. In the final form the size of the fonts on the illustrations must be at least 1,5 mm, their outline must be 0,1 mm wide. Digital documents should be submitted in JPG-format. The resolution of line-drawings must be 400 dpi, while that of photographs must be 600 dpi. The use of Corel Draw for preparing figures is highly appreciated, and in this case please submit the .CDR file, as well.

Proofs and offprints

After revision the author(s) receive only the page-proof. The accepted and revised manuscripts need to be returned to the Editors either on disc, CD or as an e-mail attachment. Proofreading must be limited to the correction of typographical errors. If an illustration cannot be presented in digital form, it must be submitted as a high quality camera-ready print.

The author(s) will receive 25 free offprints. On payment of the full price, further offprints can be ordered when the corrected proofs are sent back.

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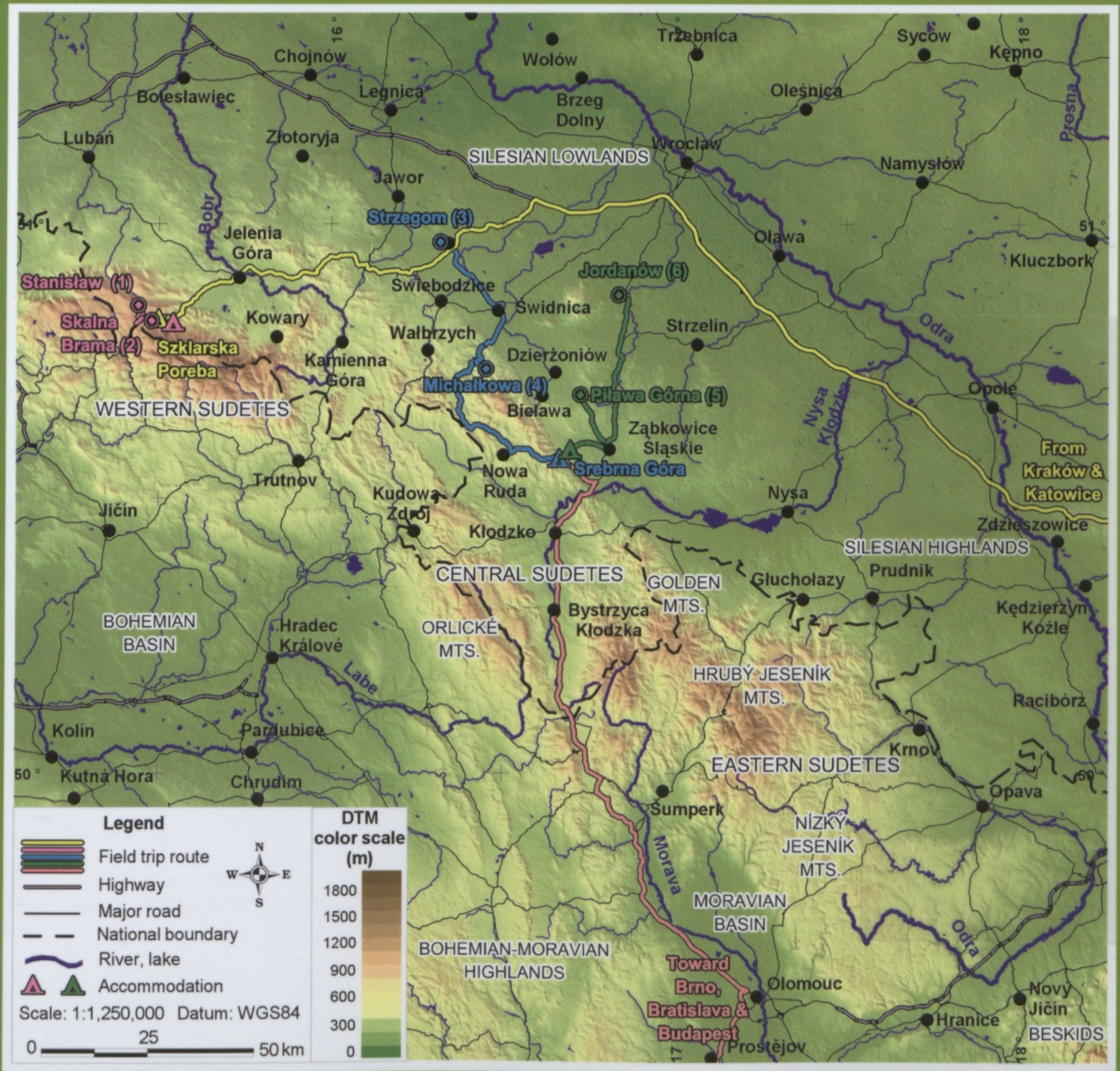
MAP OF THE IMA2010 FIELD TRIP PL2



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